INDOOR AIR QUALITY ASSESSMENT
Odor Investigation

Executive Office of Health and Human Services Center
280 Merrimack Street
Lawrence, Massachusetts

Prepared by:
Massachusetts Department of Public Health
Bureau of Environmental Health
Indoor Air Quality Program
October 2017

BACKGROUND

Building:	Executive Office of Health and Human Services (EOHHS) Center
Address:	280 Merrimack Street, Lawrence
Assessment Contact:	Bryan Kligerman, EOHHS Project Manager
Reason for Request:	Intermittent odor experienced in Department of Transitional Assistance (DTA) office area on 2nd floor
Date of Assessment:	9/29/2017
Massachusetts Department of Public Health/Bureau of Environmental Health (MDPH/BEH) Staff Conducting Assessment:	Jason Dustin, Environmental Analyst/Inspector, Indoor Air Quality (IAQ) Program
Date of Building Construction:	1906
Building Description:	5 story brick building originally constructed for wool manufacturing
Windows:	Not openable

METHODS

Please refer to the IAQ Manual and appendices for methods, sampling procedures, and interpretation of results (MDPH, 2015).

RESULTS and DISCUSSION

The following is a summary of indoor air testing results (Table 1).

- ***Carbon dioxide*** levels were below 800 parts per million (ppm) in the areas surveyed, indicating adequate air exchange for the population at the time of assessment.
- ***Temperature*** was within the MDPH recommended range of 70°F to 78°F.
- ***Relative humidity*** was within the MDPH recommended range of 40% to 60%.
- ***Carbon monoxide*** levels were non-detect (ND).
- ***Particulate matter (PM2.5)*** concentrations were below the NAAQS of 35 $\mu g/m^3$.
- ***Total Volatile Organic Compounds (TVOCs)*** levels were ND.

Ventilation

It can be seen from Table 1 that carbon dioxide levels were below 800 ppm in the area of concern indicating adequate air exchange. The EOHHS center and the Department of Transitional Assistance (DTA) area are served by large air handling units (AHUs) located in mechanical space within the building. Fresh air is provided to these AHUs through intake vents located on the roof.

Odor Concerns

The primary reason for this IAQ assessment was to investigate the source of an odor in the DTA space on the second floor. The air testing focused on a small area just outside the file room and the file room itself. According to DTA occupants, this is the suspected area of the odor origination. DTA occupants also reported that the odor is intermittent in nature and that the odor is more pronounced on hot days. Some occupants described the odor as a "rotten garbage" smell while others referred to the odor as a "burning trash" smell. IAQ staff did not detect any odor in the DTA space at the time of assessment. IAQ staff did detect a burning trash odor as well as a new asphalt sealant odor in the parking lot upon entering the building. The temperature on this day was only about 64°F with a westerly wind.

Air fresheners, an air filter, and a running fan were noted in the area of the odor complaints. All of these items were used to mask odors but do not remove or disperse the actual source.

Ongoing construction was observed while performing an assessment of the building exterior. IAQ staff observed a large opening in the rear of the building as well as construction upwind and west of this facility and (Pictures 1 and 2). The building developer for 280 Merrimack Street, Lupoli Development, was interviewed by IAQ and EOHHS staff. During this interview, Lupoli representatives reported that work recently began on an abandoned, interior elevator shaft that runs the entire height of the building. This work coincided with the commencement of the odors. Contractors removed barriers which formerly covered many of the old elevator door openings (Picture 3). In addition, the contractors created an exterior access entrance in the rear of the building so construction equipment (excavators, bobcats, etc.) can be brought into the bottom of the elevator shaft area for excavation/construction (Picture 1).

According to Lupoli representatives, this abandoned elevator shaft is adjacent to the file room area where odors were reported to be strongest by DTA staff.

In order to explain how moisture/pollutants may be impacting the second floor, the following concepts concerning heated air and the creation of air movement must be understood.

- Heated air will create upward air movement (called the stack effect).
- Cold air moves to hot air, which creates drafts.
- As heated air rises, negative pressure is created, which draws cold air from outdoors through cracks or crevices in foundation walls or passive air vents (PAVs) in the foundation.
- Air moves from areas of high pressure to low pressure.
- As air rises, airborne pollutants will travel in the created air stream.
- As the range of temperature between hot and cold air increases, the rate of upward airflow increases.

The conditions noted in the building are different with the creation of the large opening in the rear of the building and the lack of a vent/chimney to exhaust any natural upward air movement. The covered elevator shaft is most likely put under *positive pressure* during certain northerly wind conditions. This wind direction would likely pressurize the elevator shaft and push any moisture, odors, and pollutants through cracks/gaps in the brick and mortar and into occupied spaces where pressure is lower than that created by the wind pressure in the shaft. Alternate conditions of *negative pressure* in the shaft may also be created but instead of being exhausted outside, rising warm/bouyant air may be escaping the shaft in an uncontrolled manner through any gaps/cracks and entering the office space. In this scenario, the pollutants are drawn in from the lower level with the cooler makeup air. In both cases, pollutants may come from the construction area within the elevator shaft or from nearby sources (other construction, manufacturing, vehicle idling, etc.) adjacent to the building. Therefore, odors may differ depending upon the source being drawn or pushed into the elevator shaft. Also, in both scenarios, the brick work of the abandoned elevator shaft is not designed to be airtight or prevent gases from passing through the tiny holes/cracks in the mortar.

Lupoli representatives reported that they have recently made alterations to the AHU units serving the DTA area to slightly pressurize the office space. This is one step in preventing the migration of pollutants to occupied areas during construction. Other steps may include putting

the area of construction/elevator shaft under negative pressure and exhausting the stream in a controlled manner away from air intakes etc. Sealing pathways, using effective barriers, and altering the work schedule of particularly dusty/odorous activities to unoccupied hours are further steps which may be taken. The MDPH guideline "Methods Used to Reduce/Prevent Exposure to Construction/Renovation Generated Pollutants in Occupied Buildings" has been included with this report as Appendix A. Project managers should review this MDPH guideline as well as consult with a Certified Industrial Hygienist (CIH) to design a site-specific mitigation strategy to effectively eliminate the migration of pollutants to occupied areas.

Delays between when occupants log building complaints and when a building condition (e.g., odor) actually occurs makes it very difficult to observe and respond to such conditions in real time. Establishing a real time log or communications chain with project managers will prove to be very helpful in resolving any concerns in a timely manner.

CONCLUSIONS and RECOMMENDATIONS

In view of the findings at the time of the visit, the following recommendations are made:

1. Consult with a Certified Industrial Hygienist (CIH) to design a site-specific mitigation strategy to effectively eliminate the migration of pollutants to occupied areas.
2. Project managers should also review the attached guideline (Appendix A) to take further actions that will eliminate introducing pollutants to occupied space during construction activities. Some strategies may include further pressurization of occupied areas, depressurization of the construction area/elevator shaft, using effective barriers, and performing dusty/odorous activities during unoccupied hours. Any alterations to ventilation strategy should be approved by the CIH.
3. Properly seal any other gaps or breaches in the shared walls/doors between occupant areas and unconditioned space (Pictures 4 and 5).
4. Continue to properly seal any holes/cracks/gaps in brick and mortar adjacent to abandoned elevator shaft (Picture 6) in DTA space.
5. Develop a logging system so that occupants can immediately report any odors/conditions to an assigned representative so that contractors and consultants can respond in a timely and effective manner to make real time alterations in their strategy if conditions warrant.

6. Refer to resource manual and other related indoor air quality documents located on the MDPH's website for further building-wide evaluations and advice on maintaining public buildings. These documents are available at http://mass.gov/dph/iaq.

REFERENCES

Massachusetts Department of Public Health (MDPH). 2015. Indoor Air Quality Manual: Chapters I-III. Available at: http://www.mass.gov/eohhs/gov/departments/dph/programs/environmental-health/exposure-topics/iaq/iaq-manual/.

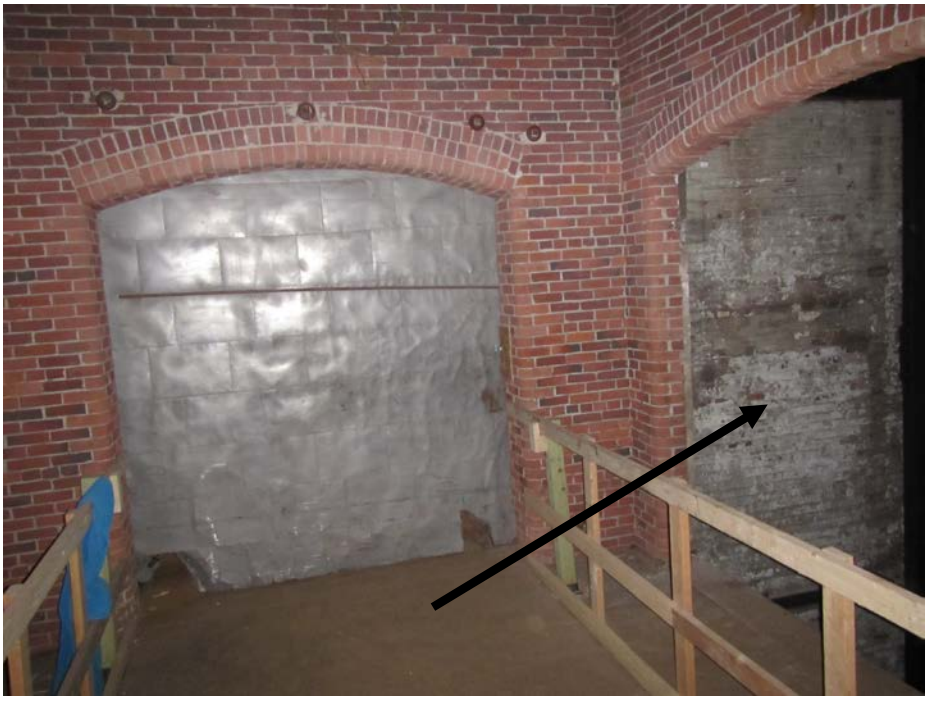
Picture 1

Large opening in rear of building (note construction vehicles inside)

Picture 2

Other construction activity in the area

Picture 3



Elevator shaft area showing door removed

Picture 4

Door leading from unconditioned area to occupied area

Picture 5

Gaps in barrier between occupied and unconditioned area

Picture 6

Many cracks/holes were noted in brickwork adjacent to old elevator shaft

Location: EOHHS Center (DTA, 2nd floor)

Address: 280 Merrimack Street, Lawrence, MA

Indoor Air Results

Date: 9/29/2017

Table 1

Location	Carbon Dioxide (ppm)	Carbon Monoxide (ppm)	Temp (°F)	Relative Humidity (%)	TVOCs (ppm)	PM2.5 (µg/m^3)	Occupants in Room	Windows Openable	Ventilation		Remarks
									Intake	Exhaust	
Background (outside)	487	ND	64	57	ND	17	-	-	-	-	Clear, Westerly wind, burning trash odor & asphalt sealant odor outside
Outside file room	584	ND	70	45	ND	7	3	N	Y	Y	Area of odor complaints, cracks/holes in brickwork, air fresheners noted
File room	597	ND	70	45	ND	9	1	Y	Y	N	Gaps in barriers between occupied/unconditioned area, Air Filter & Fan running

ppm = parts per million ND = non detect µg/m^3 = micrograms per cubic meter

Comfort Guidelines

Carbon Dioxide:	< 800 ppm = preferred	Temperature:	70 - 78 °F
	> 800 ppm = indicative of ventilation problems	Relative Humidity:	40 - 60%